

Application Serial No. 09/831,996
Amendment Dated March 12, 2004
Reply to Office Action Dated February 12, 2004

Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claims 1-17 (canceled)

18. (new) A navigation system for performing and assisting surgical operations, in particular in the area of neurosurgery and ear-nose-throat medicine, comprising:

an image database for storing preoperatively prepared nuclear-spin or computer tomography images;

a computer with a monitor for image data processing and display;

a tracking device comprising

a constant-field transmitter generating a specified constant DC magnetic field in the navigation environment, and

a pointer navigation instrument with an integral magnetic-field sensor, the integral magnetic-field sensor detects its own position or an associated position of the pointer navigation instrument by direction-oriented field-strength measurements,

the tracking device determining a momentary position of the pointer navigation instrument and deriving real-time representations of a patient's anatomy on the basis of images stored in the image database;

means for extracting anatomical structures from the raw data sets of the preoperative images and for making these structures available in the form of visualizable three-dimensional data sets;

means for the menu-guided control of the system, wherein movements of the pointer navigation instrument outside an operation field but within a navigation environment activate or deactivate menus or control measures, a moment of switching to activate or deactivate menus or control measures is determined by the integral magnetic-field sensor crossing a spatial distance or becoming situated at a boundary,

Application Serial No. 09/831,996
Amendment Dated March 12, 2004
Reply to Office Action Dated February 12, 2004

and control commands are initiated or confirmed by a switch or key in the pointer navigation instrument.

19. (new) The navigation system of claim 18 further comprising an image processing module of the personal computer for three-dimensional processing of the computer-tomography and nuclear-spin-tomography data to provide an image for planning an operation and therapy that is identical to findings from a craniotomy.

20. (new) The navigation system of claim 19 wherein the image-processing module anatomically permits a selection of structures from complete data sets according to their properties or surroundings, and on the basis of a predeterminable segmentation strategy, discrete data sets are produced.

21. (new) The navigation system of claim 20 wherein the constant-field transmitter is disposed near a patient support but outside the operation field to provide a fixed, reproducible positional relationship between an organ of the patient that is to be navigated and the constant-field transmitter, regardless of the position of the patient support in space.

22. (new) The navigation system of claim 21 wherein the integral magnetic-field sensor sends out navigation signals from which the position and/or direction of movement of the pointer navigation instrument can be derived on the basis of a specified constant magnetic field and its orientation, the navigation signals being displayable on the monitor and used to control the reloading and updating functions of the image processing module.

23. (new) The navigation system of claim 22 further comprising a second magnetic-field sensor attachable to the patient and detecting changes in location and orientation of the patient with respect to the constant-field transmitter.

Application Serial No. 09/831,996
Amendment Dated March 12, 2004
Reply to Office Action Dated February 12, 2004

24. (new) The navigation system of claim 23 wherein the second magnetic-field sensor provides output signals to the computer as corrective data, in order to specify a coordinate system that is quasi-dynamic or alterable with reference to a source alteration.

25. (new) The navigation system of claim 18 further comprising a fiducial comprising a flat carrier attachable to the patient by means of an adhesive surface, the flat carrier comprising an at least partially flexible body with a catch knob substantially centered therein and projecting from a side of the carrier away from the adhesive surface,

a container separable from the flat carrier, and

a contrast-marking substance within the container, the contrast-marking substance being contained in a hollow cylindrical housing, an underside of the cylindrical housing comprising a concave shape with a catch receptacle disposed therein, so that object curvatures can be compensated by the concave shape of the underside of the cylindrical housing.

26. (new) The navigation system of claim 25 wherein the cylindrical housing comprises a removable housing lid made of a transparent plastic, so that the marking substance can be inspected and exchanged.

AI 27. (new) The navigation system of claim 25 wherein the contrast-marking substance is a liquid or a gel for nuclear-spin tomography and is situated in a closed container, such that an outside diameter of the closed container corresponds substantially to an inside diameter of the cylindrical housing.

28. (new) The navigation system of claim 27 further comprising a closed initialization element having dimensions and an underside configuration corresponding to the cylindrical housing, the closed initialization element comprising a lid side with a marking depression in a position common with a center of gravity of the closed container.

Application Serial No. 09/831,996
Amendment Dated March 12, 2004
Reply to Office Action Dated February 12, 2004

29. (new) The navigation system of claim 28 wherein the cylindrical housing and the initialization element are made of a plastic material, and the carrier comprises a film coated on a side of the carrier with the adhesive surface.

30. (new) The navigation system of claim 18 wherein the pointer navigation instrument comprises:

- a handpiece housing;
- an encapsulated sensor disposed in the handpiece housing; and
- a contact tip partially projecting out of the handpiece housing, the encapsulated sensor being rigidly connected to one of
 - the contact tip,
 - a receptacle for the contact tip, or
 - an insertion aid by means of a connecting element with openings substantially opposite one another, wherein the sensor and the contact tip are disposed in respective openings, and the connecting element is mounted quasi-cardanically so as to be yielding and stress-free with respect to the handpiece housing, and the connecting element is made of one of titanium or a plastic that is resistant to deformation and thermostable.

31. (new) The navigation system of claim 30 further comprising a signal key disposed in a wall of the handpiece housing in a vapor-tight and liquid-tight manner.

32. (new) The navigation system of claim 31 further comprising a vapor-tight and liquid-tight cable outlet disposed in an end of the handpiece housing opposite the contact tip, the connecting element and the cable outlet being connected to the handpiece housing by external couplings.

Application Serial No. 09/831,996
Amendment Dated March 12, 2004
Reply to Office Action Dated February 12, 2004

33. (new) The navigation system of claim 31 further comprising:

a sensor-receptacle opening of the connecting element disposed in the handpiece housing, such that an annular gap is formed between the connecting element and an interior of the handpiece housing; and

at least one flexible sealing ring is disposed in one of the annular gap between the connecting element and the interior of the housing, or an external coupling and the handpiece housing.

GI